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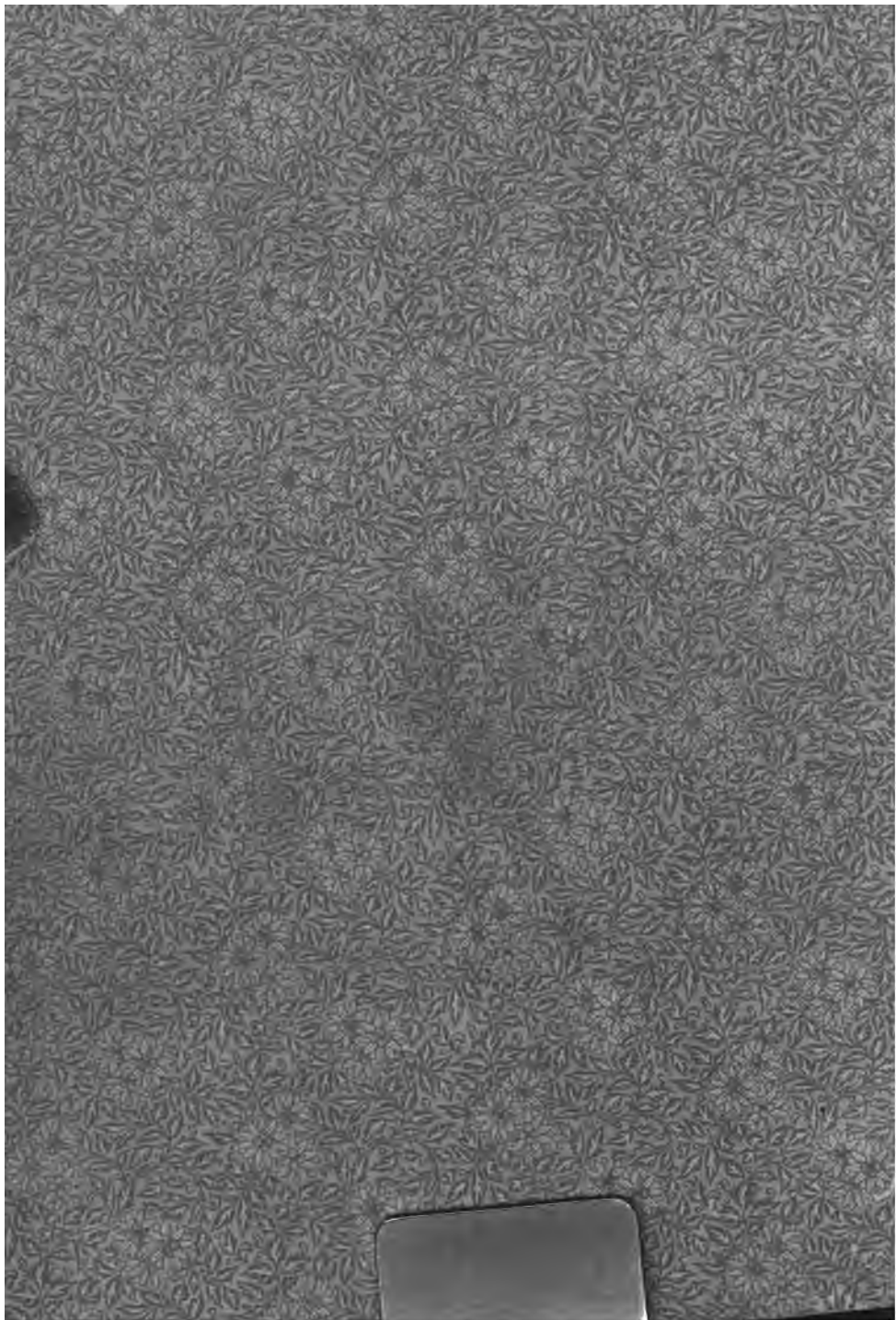
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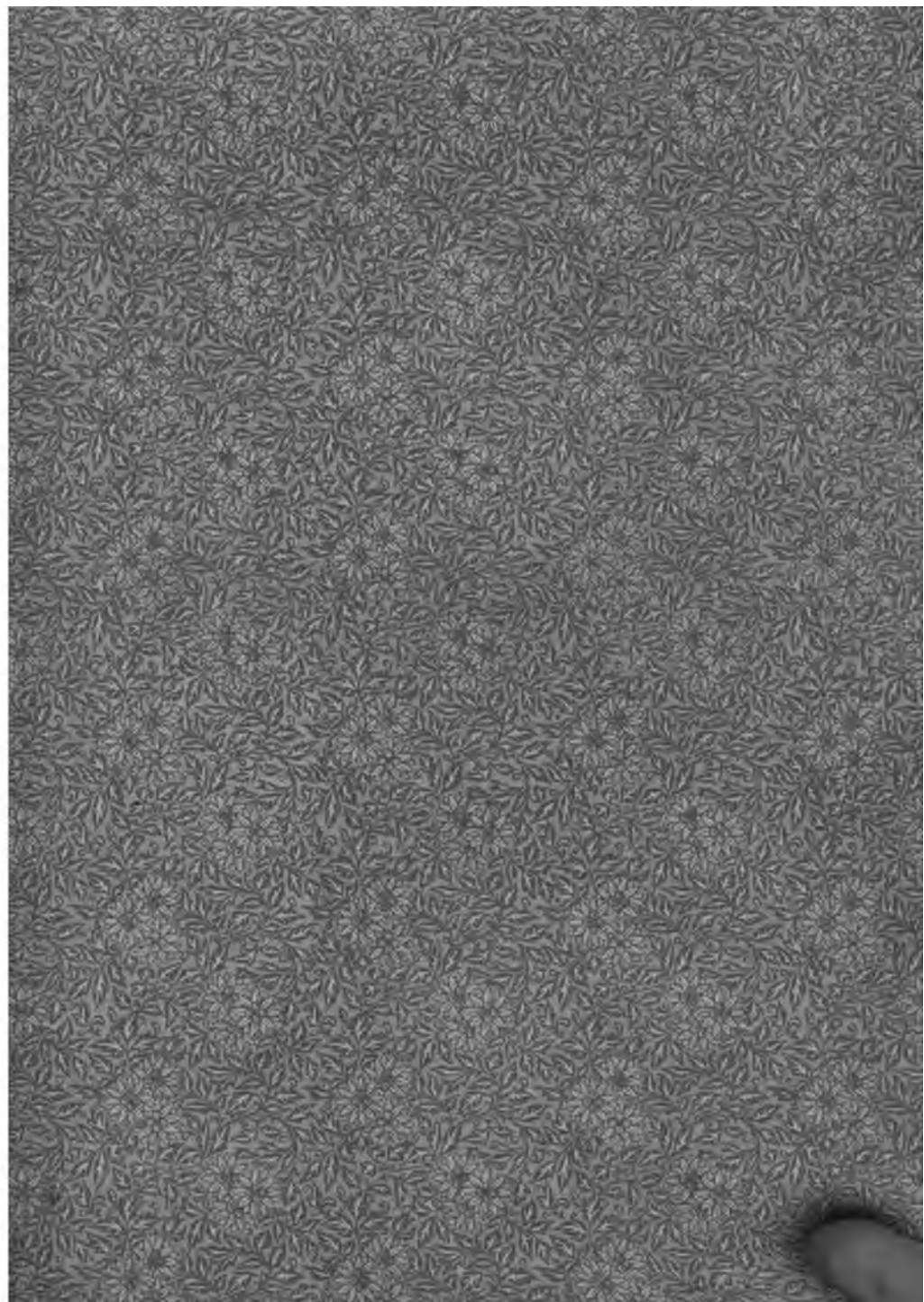
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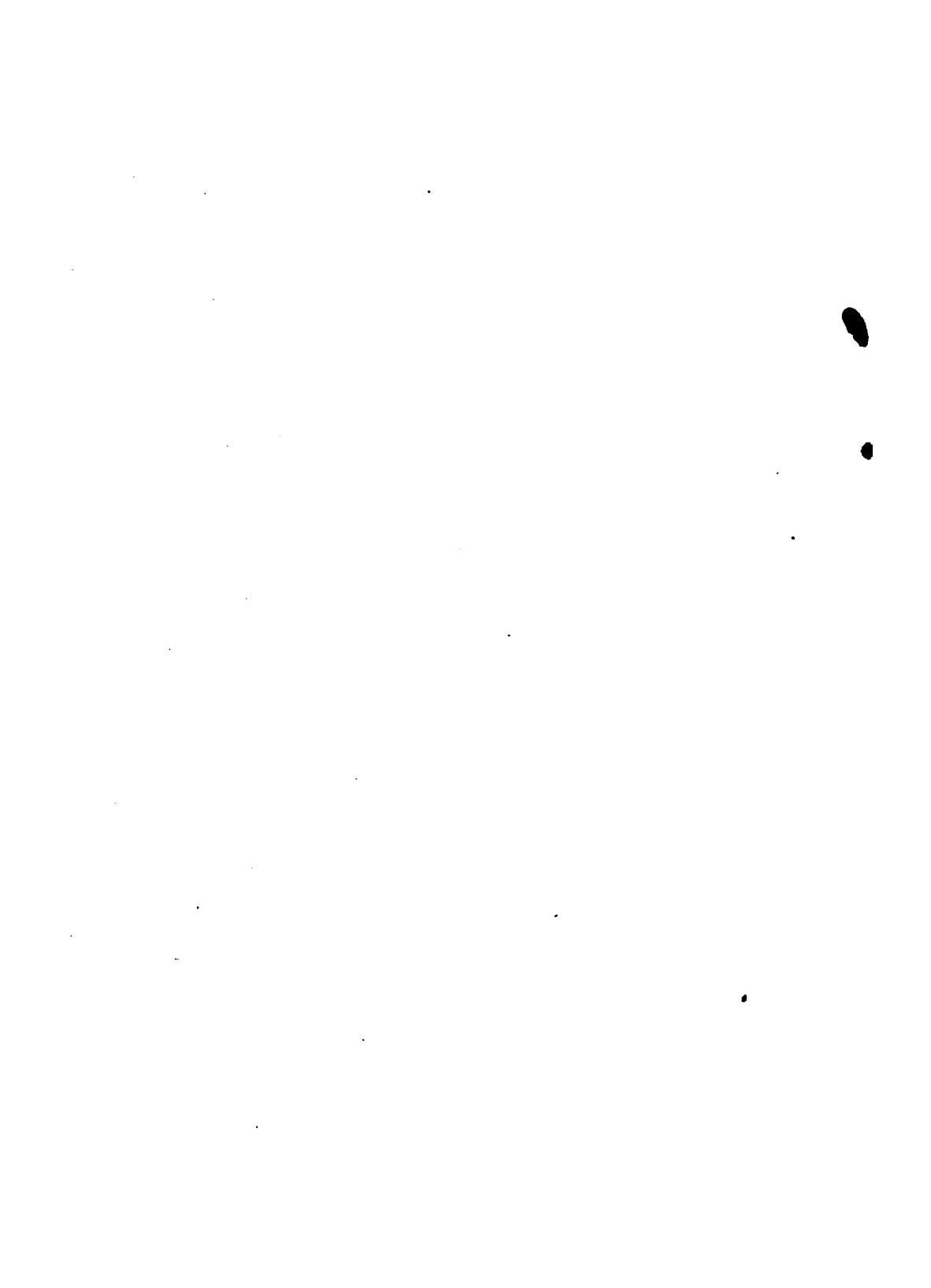


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A CENTURY OLD















Timothy H. Earle

PRINTED BY
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WORCESTER, MASS.



Samuel J. May

HISTORY
OF THE
AMERICAN CARD-CLOTHING INDUSTRY.

BY
H. G. KITTREDGE
AND
A. C. GOULD.

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PREFACE.

PORTIONS of the matter contained in the following chapters have previously appeared in papers devoted to the textile industry. Recognizing the value of this, and knowing its perishable nature if recorded only in a newspaper, the publishers have corrected certain errors in what has heretofore appeared in print, have made many additions, and by printing and circulating it in book form among their friends and customers they wish to commemorate the centennial anniversary of the existence of their business.

As the late TIMOTHY K. EARLE contributed so much to bring the Card-Clothing Industry to its present condition in this country, the publishers deem it only fitting that his portrait and a slight memoir of his life should appear in these pages.

T. K. EARLE M'F'G COMPANY.

WORCESTER, MASS., January, 1886.



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HISTORY

OF THE

AMERICAN CARD-CLOTHING INDUSTRY.

CHAPTER I.

ITS EARLY HISTORY AND INVENTIONS.

THE importance the card-clothing industry bears to the textile industry of this country is manifested in the fact that it directly contributes to the successful employment of \$350,000,000 of capital which is invested in cotton and woolen manufactures. With only three exceptions, the industry is confined to six towns in the State of Massachusetts; and, although no large fortunes have been amassed by those engaged in this industry, they have in most cases been prosperous, largely due to the fact that American card-clothing manufacturers are, as a class, men of thrifty and correct habits, their business requiring the greatest

care and constant personal supervision, and necessitating employés possessing the same qualifications.

The use of some instrument for carding, or preparing wool to facilitate its being spun into thread, has been among the devices of man from the earliest eras of historical record. It is doubtful if carding was contemporaneous with spinning, for it is quite possible to spin the raw material into yarn without the intervention of any mechanical contrivance. The history of card clothing as we know it to-day, in its manufacture by machinery, is scarcely a century old. Immediately before this the making of card clothing was the work purely of manual labor, and the substitution of mechanical means did not affect the principle of construction. With the inventions in textile machinery that rapidly followed each other in the latter part of the eighteenth century, the necessity of some expedient by which card clothing could be more rapidly and uniformly made, was imperative; without it the ingenuity of man would have been seriously impeded in bringing his schemes to a satisfactory fruition. The manufacture of card clothing by machinery, before the latter part of the last century,

would not have been a necessity, and therefore it lacked an incentive.

The fabrication of cloth by machinery which led to our present system of manufacture, had its commencement in 1738 with John Wyatt's patent of a cotton-spinning machine.

An era of inventions now seemed to be intuitively felt, and new appliances steadily followed one another in progressive strides toward enlarged operations in commercial and manufacturing enterprises. In 1743 John Kaye brought forth his fly-shuttle, which received a new value by his son's invention of the rising-box on the loom, in 1769. The most interesting invention connected with our subject was that of Lewis Paul, who patented, in 1748, a cylinder-card for carding cotton, the cylinder being covered with sheet card clothing, and this obliged further inventions to dispose of the more rapid accumulation of carded stock. The Spinning-Jenny, Throstle-Frame, and Mule, soon succeeded, to be followed by the Power-Loom. Inventions for converting stock into cloth had now assumed a practicability that demanded some mechanical method by which the cotton used could be more readily prepared for manufacture.

This was happily consummated by Eli Whitney in 1792, in his invention of the Saw Cotton-Gin.

The rotary card of Lewis Paul, is, in principle, the same as used to-day in cotton-mills.

Like many others, whose creative powers have contributed to the industrial progress of mankind, Paul was not successful in his operations, and his machines passed into the hands of a hat manufacturer of Leominster, England, who applied them to the carding of wool. The conception, the invention of Paul, however, did not lie dormant, for in 1760 the cylinder-card was introduced into Lancashire, near Wigan, for the carding of cotton. Ten years after this Sir Richard Arkwright greatly improved the machine by making it more automatic, in the application of a continuous feed-table, and of an additional but smaller cylinder, known as the doffer, from which the cotton was continuously discharged by the operation of a vibrating comb. The practicability of this new system was immediately appreciated, was patented in 1775, and became an important factor in the growth of English manufacture.

The objects of carding are to detach the fibres of the stock and lay them parallel, and the accomplish-

ment of these rests in the reciprocal motion of two surfaces which are covered with short, pointed teeth, and between which the stock is placed. It is to these pointed teeth that we propose to devote this series of articles.

During our Revolutionary War communication with foreign nations was practically at a stand-still, and this serious interruption greatly affected our industries by making all machinery and implements very expensive, even if it were possible to obtain them at all. Realizing the urgency of the situation, several of the colonies passed resolutions "recommending and encouraging bounties to manufacturers of wool and cotton *cards*, *iron wire*, etc." The making of cards for carding cotton and wool was as much a part of the economy of a community, as the spinning-wheel and hand-loom. The garments of a household were dependent on the first process which the hand-cards gave to the raw material; without them the wool of the sheep and the cotton of the fields would have remained unwrought. The significance of encouraging their manufacture was too apparent to the isolated colonists; the few small shops then existing were inadequate to the demand, and the high cost of

materials prevented their continuance without colonial or public assistance.

There are records of the existence of several establishments for the manufacture of cards during the Revolutionary War. There was one at Providence, R.I., which was conducted by Daniel Anthony. The colony of Connecticut, fully recognizing the importance of sustaining the card industry, and the subsidiary industry of wire-drawing, gave a substantial assistance in the form of a loan of \$1,500, in 1775, to one Nathaniel Niles, of Norwich, to enable him to prosecute the manufacture of fine iron wire for card-teeth. Mr. Niles erected buildings for the purpose, and kept his works running till sometime after the close of the war. The high cost of manufactured iron, as well as the difficulty of procuring it, was particularly felt in the supply of tacks used in the card business, and this led Jeremiah Wilkinson, of Cumberland, R.I., a hand-card-manufacturer, to undertake the making of tacks by cutting them out from sheet-iron with a pair of shears, and hammering heads on them in a vice. Among the earliest inventions for the making of card-teeth by machinery was that of Oliver Evans, in 1778, a young man of Philadelphia, who was employed in

manufacturing card-teeth by hand. His machine was capable of making 1,500 teeth a minute, which was a great advance over anything ever done before. Not meeting with the patronage and support which he anticipated he disposed of his machine and plans to other parties. He afterwards devised plans for pricking the leather, and for cutting, bending, and setting the teeth; but these he abandoned because of the disheartening results of his former efforts. Others, however, took them up, and they furnished the foundation of subsequent patents.

The inventions of Evans are thought to have been applied to machines used by Giles Richards, of Boston, in 1788, who had established the hand-card business, and erected a factory near Windmill Bridge. The power of the mill was derived from a wind-wheel. A machine tended by one man was capable of cutting and bending wire in twelve hours sufficient for 240 cards, at a great reduction in cost of labor. The factory was considered a valuable acquisition to the industries of Boston, and was referred to with pride by the local inhabitants. Strangers visited it, when permitted, with more than ordinary interest, and it

was opened to the inspection of President Washington during one of his Eastern tours, who intently watched the mechanical operations that furnished, in the mill and at home, employment for 900 persons in the manufacture of 63,000 pairs of cards per annum. Washington wrote, in 1789, of these machines as "executing every part of the work in a new and expeditious manner, especially in cutting and bending teeth, which are done at one stroke."

Rude and imperfect as the machines would be considered now, they were then the wonder of the community, in that they had carried the manufacture of cards far in advance of anything ever accomplished in England, cheapening production in the face of disadvantages to the extent of allowing exportation at a profit. Mr. Richards had at one time associated with him, Amos and William Whittemore. Mr. Giles Richards' brother Mark carried on an extensive business in the manufacture of cards in 1794, near Faneuil Hall. The factories of Giles and Mark Richards and one operated by Amos Whittemore supplied four-fifths of the number of cards made in the State, sending a large portion of the production to the Southern States. These three establishments

made 12,000 dozens of wool and cotton cards, consuming 35,000 tanned sheep and calf-skins, and \$26,000 worth of iron wire, which gave employment to over 2,000 men, women, and children. The wire was obtained from a wire-mill at Dedham, Mass., which was erected specially for the manufacture of wire for cards and fish-hooks. The usual process of making cards at this time was to take a strip of leather fifteen to twenty inches long, by four inches wide, and rule it off into small quadrilateral sections. Two holes were made at a time by a double-needed pricker, at the intersections of the lines, and the two-pronged staples, which had been previously bent in a machine, were inserted into the holes, one at a time, by hand. The second bend on the staple then being made, the card was tacked on a board ready to be used for carding either wool or cotton.

About the year 1784 a Mr. Chittenden, of New Haven, Conn., devised a machine for taking the wire from the coil, cutting it into teeth and giving them the first or double bend. It was capable of making 86,000 teeth in an hour. It is possible Mr. Giles Richards took advantage of this machine as well as of the plans of Mr. Evans.

In 1785 the town of Leicester, Mass., received the foundation of its prosperity in the manufacture of card clothing, through the enterprise of Edmond Snow, who then commenced the making of hand-cards which were mostly used for wool by the spinsters of the neighborhood.

The young Republic of the United States was fully alive to the necessity of an industrial independence as well as a political one. The States had incorporated many of their prerogatives into a general constitution governing the whole, which gave a mutual dependence on one another. Each and every State became sensible of the importance of inviting to our country the skill of the Old World, and encouraging the ingenuity of native talent. The field was open to usefulness.

In 1789 Samuel Slater left England, and landed in New York; in the year following he was induced to begin the manufacture of cotton goods by machinery, which he did in the State of Rhode Island, thereby originating in this country the manufacture of cotton-cloth by mechanical power. One of his most annoying obstacles was the difficulty of procuring a supply of properly constructed card clothing, and it was not

overcome until 1790, when he fortunately made the acquaintance of Pliny Earle, of Leicester, Mass., who had been in the hand-card business since 1786. It was a new, untried undertaking, but Mr. Earle agreed to make for Mr. Slater the clothing for his machines; and this decision gave to *Mr. Earle* the honor of *being the first* to engage in the manufacture of *machine card clothing in the United States*. The cards made for Mr. Slater were from sheets of calf-skins, cut into strips 18 inches by 4 inches. The teeth were made by machinery, but the holes were pricked by hand with a couple of needles fastened in a handle. One hundred thousand holes were thus pricked. Mr. Slater put the clothing on his machine, but was not successful in making it do good work, much to his vexation of mind and body. With his natural determination he mounted his horse and rode a distance of forty miles to Leicester, Mass., where he found Mr. Earle, who accompanied him back to his mill to set things right, if possible. Mr. Earle found that the teeth had been pressed down by too severe grinding and hard usage; but these he soon raised and placed in position, which rectified the difficulty to the satisfaction of Mr. Slater.

CHAPTER II.

PLINY EARLE AND HIS SUCCESSORS. — RECORD OF A CENTURY. — THE T. K. EARLE MANUFACTURING COMPANY.

PLINY EARLE was born Dec. 17, 1762. He was a man of sound common-sense, cultivation, and great hospitality, and lived in a large mansion in the outskirts of the town of Leicester, Mass.

He was one of the first to engage in the manufacture of hand-cards, commencing his business in 1786, and in 1790, as previously stated, he produced for Samuel Slater the first machine card clothing made in America; thus he largely contributed towards successfully planting this now great manufacturing industry. The business which Mr. Earle began in a small way has ever since been kept in the Earle family, descending from generation to generation.

The leather first used by Mr. Earle was calf-skin, but in time he adopted cowhide, which was tanned especially for the purpose. For hand-cards sheep-skin was in general use. The teeth in the clothing

for Mr. Slater's cards were set diagonally, which led Mr. Earle to the invention of a machine for pricking *twill*ed cards, for which he obtained a patent, Dec. 6, 1803. The letters-patent were destroyed in the fire of 1836, and have not been restored. In 1791 his brothers, Jonathan and Silas, became associated with him in business, under the firm-name of Pliny Earle & Brothers. In 1815 Silas Earle commenced business in his own name, and so continued till his death in 1842. He accumulated a liberal fortune and built a large mansion not far from his brother Pliny's. Mr. Pliny Earle died in 1832, and left a reputable name and business, which had a beginning in 1786, to successors, who are now represented in the well-known concern of T. K. Earle Manufacturing Company, of Worcester, Mass., which was formed Jan. 1, 1880.

Timothy Keese Earle, whose portrait occupies the first page of this work, was born Jan. 11, 1823. He was a son of Henry and Ruth Keese Earle, of Leicester, Mass.

At sixteen years of age he commenced the business of card-making with his uncle, Silas Earle, and in a few years purchased his business. He subsequently, in 1842, moved his business to Worcester and associ-

ated his brother Edward Earle with him, under the firm name of T. K. Earle & Co. In 1857 they built the largest factory in America for the manufacture of card clothing, and, with the many additions made since it was first constructed, it is still much larger than any other American establishment for this business.

Edward Earle retired from the business in 1869 and died May 19, 1877, and his interest in the business was purchased by T. K. Earle's twin brother, Thomas, who died in 1871. In 1872 Edwin Brown, of Worcester, a son-in-law of T. K. Earle, became a partner in the business. In 1880 a company, under the name of the T. K. Earle Manufacturing Company, was formed with T. K. Earle as president, and Edwin Brown as agent and treasurer. T. K. Earle died Oct. 1, 1881, at the age of fifty-eight years. He was the acknowledged head of the card-clothing business in America. Quick to recognize ability in others, and to appreciate what was needed in his business, he always associated with himself employés and mechanics of only the highest ability, and most of the important improvements in the manufacture of card clothing originated in his factory. The T. K. Earle Manufacturing Company abate no part of their predecessor's energy or determination to

make the best goods that can be produced. The most recent and improved card-setting machine has been invented in their shop by Oliver Arnold, who inherits the inventive genius of his father, Addison Arnold, who was one of the early card-makers and inventors. T. K. Earle and Co. were the first to publish a book of estimates of the number of square feet of card clothing required to cover any size cylinder. They printed five large editions of this most useful work to carders, and distributed them gratuitously among their customers. Before this book of estimates was issued bills for card clothing could not be verified without long calculations being made. It was during a visit to the card-setting machine-room of the T. K. Earle Manufacturing Company that a well-known English card-maker, after examining the fine work of the machines, said, "If I were going to start another card factory in England, I should order American machines, as they are much superior to the English, and turn out finer work." The T. K. Earle Manufacturing Company own a number of patents on their improvements in the method of producing card clothing. Pliny Earle made one kind of card clothing, viz., iron wire teeth set by hand in leather. To show the difference in the demand

for card clothing between that time and the present, the T. K. Earle Manufacturing Company now make all kinds of leather card clothing, using both hemlock and oak tanned leather, over ten varieties of rubber-faced card clothing, over ten varieties of cloth card clothing, and use eighteen or more sizes of soft steel wire, eleven or more sizes of hardened and tempered steel wire, besides tinned wire and brass wire of various shapes and sizes. They curry their own leather, manufacture card cloths and rubber-faced card cloths for themselves, and for other card-makers. They have built almost all their card-setting machines in their own machine-shop, and are constantly making improvements in the quality and the methods of making card clothing.

The T. K. Earle Manufacturing Company, of Worcester, Mass., have manufactured double and single cover cloth for foundation for card clothing for the past fifteen years, having special and improved machinery for the purpose, and in 1883 they built a factory on their premises for the manufacture of all kinds of card cloths, including vulcanized rubber facings. With the very best American and English machinery, and the most improved process of vul-

canizing rubber for this purpose, they are now prepared to furnish not only their own large card-clothing factory with card cloths, but have sufficient capacity to make them for all the card-makers in America.

Since they first commenced the manufacture of card cloth, which was formerly all imported from England, the price of rubber card cloth (one of their specialties) has decreased over fifty per cent., thereby reducing the cost of card clothing of this kind, to manufacturers, from ten to thirty-five per cent. At a recent industrial exhibition at the Crystal Palace, England, this company exhibited their products, being, we believe, the first and only American exhibit of card clothing. A medal was awarded them for excellence of the goods.

We have here the history of an honorable and successful business, a century old, that began with limited facilities, in a room of a few feet square, and which has developed into one of national import, contributing largely to the healthy growth of an important industry, which now requires a floor space of over an acre in extent to do its work and meet the demands upon it.

CHAPTER III.

ELEAZER SMITH. — HIS EFFORTS TO PERFECT THE CARD-
SETTING MACHINE.

ABOUT the time the rotary carding-machine of Lewis Paul was struggling for a recognition in England there was born in Medfield, Mass., in 1754, a youth, of humble parentage, by the name of Eleazer Smith. His education partook of the best that the schools of his neighborhood furnished in arithmetic, grammar, geography, reading and writing. A natural student, fond of reading, and blessed with a retentive memory, he secured what books he could on astronomy, botany and chemistry, and became well versed in these subjects. His mechanical turn of mind and studious habits seemed to fit him for certain branches of surgery, in which he was considered quite skilful. In early life he moved to the adjoining town of Walpole, where he afterwards lived. His house and shop occupied one of the most eligible locations in the place, on a high elevation, from which an extended view was to be had of fields

and scattered woodlands. The buildings disappeared long ago, and all trace of the spot is found only in a cellar-hole, a few old bricks that once answered for a chimney fireplace, and some old poplar trees that stand like monumental shafts.

That he was regarded as a man of erudition is noted in the visits he was accustomed to receive from acknowledged scientific and professional men, for consultation and information. Dr. Jackson, of Boston, was a frequent visitor. His favorite occupation was in mechanics, and many devices attest his ingenuity. In his boyhood he made a wooden spring trap for catching rabbits, that became a coveted instrument for sport, and which has not yet outlived its usefulness. At the age of fifteen or sixteen he constructed a complete watch, and encased it in a white-oak knot, which he fashioned with his jack-knife. It kept good time. He presented it to Mr. Aaron Wight, of Medway, who was so well pleased with it and with Smith's ingenuity, that he gave him his board for four months, and aided him in making a complement of tools for the manufacture of watches and clocks. One of his products was a clock, with wheels of apple-tree wood and a bell made from a

wineglass, which attracted the notice of Simon Pettee, a clock-maker of Wrentham, who endeavored to secure his services ; but his father was not disposed to let him turn his attention to such things, which he considered as of no profit. A clock of his, nearly one hundred years old, is still running in Walpole, and is in possession of Mr. Lewis Bowker. It is a curious and simple piece of mechanism, with only three wheels, and a pendulum which beats seconds. The face is seven inches in diameter, and made of brass with the name of Eleazer Smith engraved on it.

With many other compatriots he enlisted in the army, in 1776, and marched to the taking of Ticonderoga ; but his military career was not one congenial to his taste, and after several adventures he returned home and busied himself in inventing machines for making cards, needles, tacks, nails, pins, and other contrivances, so as "to do without England," as he expressed himself. His machine for the manufacture of solid-headed pins, and drawing the wire for them, was well devised for making 1,500 pins a day ; but they had to be pointed on a grindstone. The cleverness with which he could turn his hand in mechanism

gained for him quite an extended reputation. Mr. Jeremiah Wilkinson, a card-maker, of Cumberland, R.I., set him to work in the planning and construction of a machine for making card-teeth, which he did in one month. The operation of this machine proved very satisfactory, and when known, was the means of opening engagements to him from three parties who wished him to build like machines for them. A pair of hand-cards was valued at this time at sixteen shillings. The erection of his house and shop involved him in debt, and his financial embarrassments forced him to the harder labor of wood-chopping and general farm-work for his neighbors, which brought him in the small income of about seventy-five cents a day.

His conception of a machine for making cards, which would combine the operations of bending the teeth and pricking the holes into the leather, was being evolved at this period of his life, but his straitened circumstances too frequently required him to turn to diverting engagements. Mr. Jonathan Hale, a card-manufacturer, of Framingham, having heard of Smith's capabilities, bargained for his services in doing all such work that required the aptitude of an ingenious

hand, such as mending cart-wheels and improving machines for making card-teeth and tacks. His plans for what he termed the "Grand Machine to Stick Cards," were communicated to Mr. Hale, who sympathized with his efforts and became interested in their promotion. His creditors so worried him with their importunities, that he was obliged to seclude himself in a room under lock and key, so as to conduct his work uninterruptedly. His plans were probably of slow development, as Mr. Hale became discouraged, and on the payment of \$150 released himself from further obligations. His mind bent on accomplishing his purpose, with a nature hopeful and earnest, he conquered all disposition to disappointment, and dispelled every apparition that prophesied failure. Of an ingenuous temperament, suspecting none, he willingly unfolded his schemes to all who would favor him with a listening ear. Many did he entertain with the revelation of his designs, as he depicted here and there the mutual working of his little devices, and portrayed the revolution they would occasion when they became a reality. Few, however, believed; and the apathetic had no word to express, aside from pronouncing his notions ridiculous. Ad-

verse opinions had no weight with him; they did not diminish the confidence he had in his ideas. He would often say, "I can see right through it; I can see how every part will move." His whole nature was concentrated on his machine; he would devote days and nights, without intermission, to his work, scarcely allowing himself time to eat, and paying no attention to those who might venture near him. With a mind overtaxed and exhausted he would occasionally leave his shop and roam about the village, as if demented.

In 1784 he left the employment of Mr. Hale. At the solicitation of Giles Richards, of Boston, he subsequently went to work in the card-factory of that gentleman, who had formed a company, consisting of himself, William and Amos Whittemore, and others. He remained here twenty-one months, effecting several improvements in card-setting machinery. It was during his engagement with this company that President Washington visited the factory in 1789, when the machines were under Mr. Smith's supervision. They elicited praise from the President, although they were not working satisfactorily and showed signs of having been tampered with. Leaving

Boston he spent a whole year in improving a nail-cutting machine, which he got to be self-feeding and to cut nails with the fibre of the iron. This machine came into general use. The idea of it largely originated from a former invention of his for cutting and heading card-tacks. While at work completing a machine for making card-teeth, he was visited by Col. Thomas Denny, Jr., of Leicester, who paid him \$93 for it. In 1795 he went to Newburyport to work for Jacob Perkins in his brad-mill; but because of a disagreement in regard to a claim of originality in a nail-cutting machine, he soon returned home. Passing through Boston he called on William Whittemore, who asked him if he thought it possible to construct a machine to stick cards. He answered affirmatively, and expressed an intention to accomplish it as soon as his finances would admit of it. He had not long been at his home before his shop was the scene of busy preparations for serious labor on his "Grand Machine."

While his heart and mind were thus engrossed he was visited from time to time by those interested in the manufacture of card clothing, and especially by Amos Whittemore, and one or more of his associates.

Not doubting the honest purpose of his visitors he candidly explained his work, and made known his ideas, little dreaming that his frankness could possibly operate to his disadvantage. It appears that he mistrusted the object of Amos Whittemore's comings, whom he knew to be a skilful mechanic, quick to turn new ideas to account, and one fully alive to all improvements in the card industry. He questioned Whittemore acutely if he was not also engaged on a similar machine; but his inquisitiveness brought none other than evasive replies. His machine was gradually nearing completion. It consisted of an iron bed-plate, twenty-four inches square, with wrought-iron posts for the centre and working parts. He had succeeded in making it prick the leather, make the teeth and set them in *straight*, and was about to apply his ideas in putting on the second bend to the teeth, when he heard of the patent granted to Amos Whittemore, in 1797, who had forestalled him in this last contrivance and given the machine an automatic completeness. Mr. Smith was inclined to contest the validity of the patent, but his limited means and inability to secure pecuniary assistance, together with the imperfect knowledge then had of the patent-laws,

prevented him from doing so. Notwithstanding this, he perfected his machine by a device for making the second bend, but he never derived any benefit from it. It is evident that the achievement of Mr. Whittemore had a very depressing effect on Mr. Smith, and the disappointment was so overwhelming that he never fully recovered from it. His hopeful prospects vanished in a moment, as if they were but visions come to beguile him to deeper poverty and wretchedness. Hours, days, years, and a life had been spent in solving a problem which, when near consummation, was wrested from him by a more artful hand than his.

In 1812 he built for Pliny Earle & Bros., of Leicester, a machine for making card-teeth, to be set into the leather by hand. This machine is still in existence, and one who has seen it says: "The permanency of construction and beauty of finish would do credit to a machinist with a set of tools of the latest improvements." The Whittemore patent being confined to the exclusive use of a few, kept the old practice of setting the teeth in leather by hand in vogue till 1828. Mr. Smith died in Walpole, March 9, 1836, aged eighty-two

years. He was buried in the country graveyard, now Rural Cemetery, where a plain marble slab marks the spot of his last resting-place. In 1854 the selectmen of the town made an effort to erect a monument to his memory, but without success.

CHAPTER IV.

AMOS WHITTEMORE, HIS CONTRIBUTION TO THE CARD-CLOTHING INDUSTRY. — PERFECTION OF THE CARD-SETTING MACHINE.

AMONG the articles subject to payment of duties in the first tariff act of 1789 were hand-cards used for wool and cotton. For every dozen imported there was levied a duty of fifty cents, and this was continued till 1812, when a duty of one dollar was imposed. The tariff of 1816, and subsequent ones, make no mention of them, as they had outlived the necessity of special protection. The last decade of the eighteenth century was developing an independence in our industries, in sympathy with the political stability which we were establishing among the nations of the earth. Several woolen and cotton mills were started in embryo, to meet certain local wants of thrifty housewives. The first cotton mill, and the first woolen mill, showing a complete system of manufacture, were then organized as the beginning of two branches of a vast industry. To supply the

demands of these new and growing enterprises the inventive skill of the American mechanic was taxed to the utmost; and to encourage and protect such in the benefits and emoluments to which it was entitled, the United States Government enacted certain patent-laws, which were early called into requisition. Very few great inventions are patented in any country, that are allowed to stand unmolested as being the exclusive conception, or having priority in conception, in whole or in part, in the mind of the patentee. The greater the usefulness of the invention the greater will be the number of persistent claimants, often with just cause, but more often with immature pretensions of fancies that have not got beyond the realm of thought, and lack the existence of a reality. Patents do not depend on conception, but on execution; and the two are not always the property of the same person. He who conceives has a right to share in the honors of him who executes, and he who executes should not be divested of the glory attending the conversion of an idea into a fact, of transforming a crudity into a success. To determine the origin of an invention is a difficult, if not an impossible, task. The most beautiful and useful mechanical devices

with which we are familiar are simply the imitation of the action of the human hand. Intercourse with our fellow-men not only furnishes an incentive, but serves to create ideas to be matured into practical application.

Eleazer Smith is entitled to all the encomiums which have been connected with the products of his consummate skill as a mechanic. There is no question of his ingenuity, and that its free play was greatly fettered by his financial embarrassments and poverty. There is no doubt that he devised contrivances that gave great promise of success in facilitating the manufacture of card clothing; and that he should not have reaped the full benefit of them is no discredit to him; it was one of those unfortunate fates that not infrequently befall the greatest of men. Let not one jot be taken from whatever is due to the ingenuity of Mr. Smith; it is deserving of laurels; let them there remain. In dealing with the history of an invention we are apt to be involved in a series of deductions; and though history, pure and simple, is a chronicle of facts, it is not always easy to ascertain what are the facts. Let us review for a moment. As near as we can determine, about the year 1780,

Mr. Smith conceived the idea of one machine for combining the operations of bending the teeth and pricking the holes into the leather, and he no doubt experimented upon it during his connection with Mr. Giles Richards, of Boston. We have, also, mention of a plan of one Oliver Evans, of Philadelphia, for pricking the leather, and for cutting, bending and setting the teeth, which, it has been thought, was applied, in some form, to the machines of Giles Richards. Again, in 1784, it seems that a Mr. Chittenden, of New Haven, Conn., devised a machine for taking the wire from the coil, cutting it into teeth and giving them the first or double bend; and this device, it has been thought, was also taken advantage of by Mr. Richards, who, it is needless to say, was active in all things necessary to promote the profitable growth of his business. Not presuming to say but that Smith's conceptions were formed independent of and even earlier than either of the above, is it not reasonable to suppose that he derived some helpful aid from the contrivances in operation on Mr. Richard's machines while he was in that gentleman's employ? During his engagement in Boston he was well acquainted with Amos Whittemore, and knew

him as a very skilful mechanic, and, so far as is known, was on friendly terms with him. It is natural to believe that these two men, who were mutually interested in the same vocation, working side by side, would talk on matters that absorbed their attention in common, and become more or less familiar with each other's plans. Whittemore, having a stronger nature, was probably more discreet in imparting his schemes than Smith, whose ingenuous and communicative nature would not allow him to withhold from others what he knew and what he was doing. It is not at all unlikely that Whittemore got from Smith more than what Smith got from Whittemore, but it does not necessarily follow that Whittemore did not have other than well-laid plans of his own for his machine; for it is not disputed that he was an intelligent and proficient workman. It is impossible to determine where to divide the honors. Two things, however, are fixed: Whittemore gave the machine an automatic completeness, and secured a patent for it.

The life of Amos Whittemore runs in the same channel of many other inventors, with its hopes and despondencies. He was born in Cambridge, Mass., April 19, 1759, and was the second of five brothers,

and third in a family of ten children. His birthplace is still standing near the dividing line between Cambridge and Arlington. His father was a farmer in moderate circumstances, whose bodily strength and labors were actively and daily needed to supply the necessaries for his large family. He could give his children none other than the elementary education which the schools of his neighborhood furnished, and when their strength was sufficient to be helpful to him in the occupations of a farm, he required it of them; and the youthful days of Amos were employed in assisting his father in general out-door labors. Amos was of a meditative and philosophical turn of mind, preferring the solitude of his own reflections to the genial companionship of his associates, which, with a mechanical aptitude, seemed naturally to direct him to the abstruse in the science of invention. He was early made to feel the necessity of choosing an employment for his maintenance; and, as he was left free to make a choice, he selected the trade of a gunsmith, as having an immediate future of more profit than anything else at hand. Serving as an apprentice, he assiduously applied himself to his task and invented a number of serviceable implements,

which his employer recognized as the manifestation of a talent far above the mediocrity of a common workman. Among the many ingenious productions of his was a clock, made without a model, which long remained in the possession of his family. A Dr. Putnam, of Charlestown, becoming interested and intimate in his work, and noticing the dexterity with which he could turn his inventive talent, suggested to him the invention of a self-acting loom for weaving duck. The suggestion was at once acted upon and resulted in the construction of a loom, which, according to some information, embraced the same principle as evolved in the power-loom of the present day. The times were not propitious at this period of his life; he found but little inducement to be zealous in securing the adoption of his devices; for none seemed to care to improve the methods then in use; matters of more general interest were then engrossing the thoughts of his fellow-men.

During the war he was much of the time out of employment, and was obliged to scrupulously husband his limited resources. Some time subsequent to 1788 he and his brother William, together with five others, became associated under the firm-name of Giles

Richards & Co., for the manufacture of card clothing, and their success gave them a wide reputation. Amos devoted himself to the mechanical wants of the factory, and its prosperity was largely dependent on his management. The production of the factory was in ready demand, but the expense of manufacture was a serious encumbrance, the same as that connected with the making of wool and cotton cards everywhere, because of the imperfect and rude machines in use, and the large amount of manual labor required. Amos quickly realized the situation and saw the opportunity for a grand and substantial success for a machine that would unite all the operations in one harmonious whole. The occasion was one that appealed most happily to his nature, as a favorable time to exercise his inventive ingenuity with a hope of a lucrative return. His mind became involved in a series of evolutions, and he applied himself sedulously to experimental tasks that offered any promise of solving the question. He kept no account of time; day and night had no distinction to him, and physical and mental exhaustion only determined the time for rest. He unfolded his plans to his brother William, in whom he had

implicit confidence, and received from him encouragement and excellent advice. His incessant toil threatened the complete undermining of his constitution ; but to him this was of momentary consideration. His ingenuity was taxed to the utmost, and device after device was attempted and rejected, all seeming to baffle and militate against the accomplishment of his purpose.

The laws of physics appeared to work by contraries. At length parts began to work in more harmony with each other, and he realized a machine to draw the wire from the reel, cut and shape it, pierce the holes in the leather, and place the staples in the sheet ; but the forming of the second and final bend in the teeth was a problem that vexed his very soul as one of insurmountable difficulty. Hope was followed by despair, and the most glorious prize of all that would crown his machine with perfection, hovered around him like a phantom, enticing him on to further exertion, yet eluding his grasp. He did not lack, however, the support of encouraging friends, who believed in his ultimate success if he would only persevere believingly and courageously. To the cheerful assurances of his friends may be attributed much of his

resolution and unremitting ardor in forcing his scheme to a successful finality.

While in this maze of doubt, his brain hot with feverish uncertainty, his thoughts dwelling vaguely on a theory of possibilities, his exhausted strength permitted the solution to come to him in a dream. Such is the testimony of some, and, whether it be true or not, it is not outside a common experience of many, to retire at night with a mind confused and mystified by unabated application to a single idea, and wake up in the morning with it fresh and clear with the mystery revealed and elucidated, as if it were the work of a vision. He arose at early dawn with a heart full of emotion, and a face beaming with joy, and eagerly sought his workshop to place on his machine the last piece of mechanism that was to transform it into a magnificent consummation. The commencement and the achievement covered a space of three months, as stated in a memoir of him; but it is hardly consistent with his nature and that of the subject to confine it to so limited a period. The need of such a machine had been long recognized and discussed, and it is to be presumed that so earnest and observant a mechanic as Whittemore would not

have allowed the time to have passed without practically exercising his inventive skill in accomplishing the object. The invention was a splendid specimen of "construction, precision of movement, rapidity of performance and perfection of execution. It must be studiously examined to be justly appreciated, and its complicated performance can be compared with nothing more nearly than the machinery of the human system."

The Whittemore brothers took with them to Washington a full sized and complete machine, as a model, to be shown to members of Congress, from which they could form a better and more correct judgment than from any verbal or written description that could be given of it. It excited much curiosity and admiration at the astonishing facility with which it performed its work; and especially was its advantage to the woolen and cotton industries reckoned upon as incalculable. The petition for a renewal of the patent came before Congress for action, and, after a little deliberation, it was favorably considered and granted, March 3, 1809. The vote on the final passage of the renewing act was fifty-five in the affirmative and eighteen in the negative, and as

there is no record of the speeches made on this occasion, we have no means of knowing the nature of the objections raised against the extension, or the animosity that may have been instigated in opposition. It is a consistent presumption, however, to say that with the above vote there was some discussion made on the merits of the invention, or advisability of renewing the patent. Unanimity would have been anomalous; blessings and great inventions do not find appreciation without exciting hostility and antagonistic elements, though they may arise from the perversity of human nature, when disturbed from its conservatism. It is related of John Randolph, of Roanoke, that, when the question of extending the patent was before Congress, he expressed himself with that emphatic eloquence, for which he was noted: "Yes, I would renew it to all *eternity!* for it is the only machine which ever had a *soul!!*"

The act of renewal was as follows: —

An Act to extend to Amos Whittemore and Wm. Whittemore, Jr., the patent-right to a machine for manufacturing Cotton and Wool Cards.

Be it enacted by the Senate and House of Representatives of the United States of America, in Congress assembled, that all the privileges and benefits granted to Amos Whittemore, of the State of Massachusetts, in consideration of a machine invented by him for the manufacture of Cotton and Wool Cards, within the United States, by a patent issued from the Department of State, and bearing date the fifth day of June, one thousand seven hundred and ninety-seven, be, and the same are hereby extended to Amos Whittemore and William Whittemore, Jr., as joint proprietors of the said machine, for and during the term of fourteen years, to commence on the fifth day of our Lord one thousand eight hundred and eleven; anything in the Act entitled, "An Act to promote the progress of useful arts; and to repeal the Act heretofore made for that purpose," to the contrary notwithstanding.

J. B. VARNUM,
Speaker of the House of Representatives.

J. N. MILBRIDGE,
President of the Senate, pro tem.

March 3, 1809, approved. — TH. JEFFERSON.

(Passed the House Feb. 28, 1809.)

In the year 1803 Samuel Whittemore, a younger brother, started the manufacture of cards for cotton

and wool in the city of New York, as a branch of the business established in Cambridge; and the novelty of the machine attracted no little attention. The success of this branch is not given us, but it probably moved along slowly and inconsequentially till its reanimation by the renewal of the patent, when efforts were soon made to place it on a flourishing basis, by the addition of capital, to secure the anticipated demand and profit resulting from the practical monopoly which the exclusive control of the machine would give. It was not long in waiting before it elicited the serious consideration of men of money.

An act was passed by the Legislature of New York, June 15, 1812, incorporating Anthony Post, John Van Kleeck, Samuel Whittemore, Isaac Marquand and others, as the New York Manufacturing Company, for the manufacture of iron and brass wire, and of cotton and wool cards, with a capital of \$1,200,000. The ninth section of the act provided that "the corporation shall, as soon as the same shall be duly organized, contract for and purchase of A. & W. Whittemore, of Boston, the machinery owned by them for cutting and sticking card-teeth, together

with the exclusive right, secured to them by letters-patent from the United States, of using that and such machinery for the term of thirteen years." The corporation was required to expend by the 1st of November, 1813, in the purchase of patent-right and in the erection of manufacturing houses, machinery and hydraulic works, \$250,000, and \$50,000 per year afterwards, till the capital so invested should amount to \$500,000, which should be kept as a permanent manufacturing capital. The corporation was also required to establish in the city of New York a bank of deposit and discount, and to employ such parts of its capital stock in it as should not be otherwise appropriated, not exceeding \$700,000.

The basis of this enterprise was the machinery for making cotton and wool cards, invented by Amos Whittemore, of Cambridge, Mass., and patented June 5, 1797. Samuel Whittemore was a brother of the inventor, and on the 20th day of July, 1812, \$120,000 was paid for the patent-right for the term of thirteen years, and for the machinery of the Messrs. Whittemore. This sale took from Amos Whittemore all the rights and interest he had in his

invention, and with his share of the proceeds he retired to a pleasant estate which he purchased in West Cambridge, now Arlington, Mass., and lived a quiet and happy life, that seemed more congenial to his nature than the vicissitudes of a manufacturing and mercantile vocation.

The New York Company erected extensive works on New York island, corresponding with the large capital which had been invested in the undertaking, and the laying of the corner-stone of the main building was attended by elaborate ceremonies in harmony with the hopeful prospects that the present appeared to foretell.

The calamities of war, which at this time was destroying our commerce on the seas and subverting our intercourse with foreign countries, threw upon us the necessity of supplying our wants from domestic manufactures, which thus became stimulated into an unprecedented activity that kept the wheels of trade in constant motion.

Cotton and woolen factories sprung up as by magic, as if every water-fall was to have by its side the busy hum of machinery.

None felt the momentum of the stimulated con-

dition of affairs more than the New York Manufacturing Company, which bent every energy towards securing and supplying the demands of the hour. The return of peace, in 1815, relieved the intense pressure of a feverish inflation, and the excess was everywhere diffused, weakened, and enervated. The bountifulness of peace, an event sought for and prayed for, brought with it no consolation for the New York Company, but rather disappointments and losses, by the impairment or destruction of the channels through which it disposed of its products. The demand for its manufactures ceased almost wholly, — there was no market, — and it found itself suddenly with a large stock of goods on hand of uncertain value, and expensive machinery standing idle for want of work.

No reaction coming to favor the continuation of the business, it was decided to dispose of the property, which was accomplished by a sale, in 1818, to Messrs. Samuel and Timothy Whittemore, — brother and son of Amos Whittemore. Timothy almost immediately transferred his share to his uncle, who assumed the exclusive ownership of the property and continued the business, with varying

success, till the time of his death, in 1835. The New York Manufacturing Co., after selling its property in 1818, dissolved its coöperate title and took that of the Phœnix Bank, and has pursued the banking business, which its charter authorized it to do, to the present day. The second term of the patent expired in 1825, and the invention was given to the world. In anticipation of this event, and fearful of the effect it would have on his vocation, Samuel Whittemore sold many of his machines, and very considerably reduced the limits of his business.

A number of the machines that were used in Samuel Whittemore's factory were bought by Gershom and Henry Whittemore, sons of Amos Whittemore, and moved to West Cambridge, where a factory was started in 1827 for the manufacture of cards, and which was kept running till its destruction by fire in 1862.

As soon as the expiration of the patent released the monopoly on the invention orders were received from England and France for some of the machines; but their complication was so imperfectly understood by the foreign mechanics that workmen had to be sent from America to set up and start them.

Returning once more to Mr. Amos Whittemore we find that, with his retirement to his West Cambridge estate in 1812, he gave himself up to the ease of life and the enjoyment which he could cull from scientific reading and reflection, which his natural inclinations led him to seek. Astronomical inquiries engaged much of his time, and his ingenuity was displayed in this line of study by the construction of devices showing the principle of planetary motions, and he conceived a plan of a complete orrery, — a machine that was in high repute during his time, in the latter part of the 18th and early part of the 19th centuries, but which is now regarded with little favor.

In the latter part of his life he felt the discomforts of impaired health and the infirmities of old age. He died March 27, 1828, at his homestead. He left but a small fortune. He was spoken of as a man “of a bland and conciliating disposition, even in temper, strikingly meditative in manners, conversing but little, and often seen in profound mental study.” Over his tomb is placed a marble tablet bearing this inscription : —

Amos Whittemore,

born

April 19, 1779,

died

March 27, 1828.

Inventor of the celebrated
machine for making cotton
and wool cards; a marvelous
conception of mechanical
ingenuity, which gave him
a prominent place among
the principal inventors
of the age.

This tablet was erected by his descendants, A. D. 1882.

Desiring to give our subject a consistency as well as continuity, we have been obliged to omit, for the time being, all matter not directly connected with the career of Amos Whittemore, whose history has such a vital bearing on the existence and success of the card-clothing industry.

To return to earlier days, when Whittemore's invention was first generally known, but not generally used, because of its monopoly by the inventor and his brothers, the methods pursued when labor was almost

purely manual, with few or no mechanical devices to aid and ease the toil, called into requisition the handicraft of the neighborhood anywhere within a radius of twelve miles. The wire teeth were the product of the factory, but, in order that they be inserted into the leather, they were distributed in bags among the households of the vicinity, and thus gave employment to women and children. Every house became a part of a factory system, and the community busy in something which all could do, from the youngest to the oldest. Women and girls were the most dexterous members of the family for this kind of work.

CHAPTER V.

GROWTH OF THE CARD-CLOTHING INDUSTRY, AND SKETCHES OF PARTIES ENGAGED IN ITS MANUFACTURE.

In 1802 Mr. Winthrop Earle, an active young man of twenty-seven, began the manufacture of machine-cards, and occupied for this purpose the west end of Col. Denny's dwelling-house in Leicester, Mass. He soon after built a factory apart from his residence, and became extensively engaged in his business. His early death, in 1807, deprived the town of a most respected citizen. His business, however, did not suffer for want of a competent successor, as it was continued by John Woodcock, a young and ingenious mechanic who had come from Rutland two years before. Woodcock's inventive tact was manifested in many little devices for overcoming annoyances that afflicted the crude processes which were in fashion at that time. On one machine he secured a patent for reducing leather used in the manufacture of cards to a uniform thickness, which

proved to be of much benefit, not only to himself, but to the manufacturing community in general.

In 1808 Mr. Alpheus Smith associated himself with Mr. Woodcock, under the firm-name of Woodcock & Smith. Their factory building was moved near the hotel, where it stood for many years. In 1812 James Smith, from Rutland, joined the firm as an active member. Mr. Woodcock disposed of his interest in 1813, and his death is chronicled in the same year, having acquired a competency which he left to a family of five children. In 1814 Alpheus Smith sold his share in the business to his brothers, John A. and Rufus, and the style of the concern became James & John A. Smith & Co. The junior member, Rufus, died in 1818, and the business was carried on by the remaining partners till 1825, when John Woodcock, son of the foregoing John Woodcock, Hiram Knight and Emory Drury were taken in as partners. Within the following eight years many changes took place in the membership of the firm. Mr. Drury left it in 1829, John A. Smith in 1830, and James Smith in 1833, leaving the business in the hands of John Woodcock and Hiram Knight, who continued it alone

till 1848, when they took in their sons, Theodore E. and Dexter. The firm of Woodcock, Knight & Co. remained in existence till within a few years.

To show the state of trade in card clothing in the early history of this concern, we reproduce a letter that was written by it to a customer in want of card clothing:—

LEICESTER, June 27, 1812.

MR. E. D. WALCOTT:—

SIR,—Yours of the 18th inst. is just received, in which you observe you are in want of five or six sets of machine-cards for the Nassau Cotton and Woollen M. Society, and wish to know our terms. Our terms are cash in hand. We formerly gave a credit of three or six months upon our cards, and used to have the same credit on our stock; but now our stock commands the cash; therefore we are obliged to sell our cards for ready pay. Card wire is extremely high and difficult to be obtained at any price. The present prices of cards are for those made of No. 30 wire, \$3.00; No. 31 wire, \$3.20; No. 32 wire, \$3.40; No. 33 wire, \$3.60 per square foot; and for filleting, 1½ in. wide, 55 cents; 1¼ in., 75 cents; and 2 in., \$1.00 per foot in length. The above are the prices that we and others are selling cards in this place. We will engage the cards at the above prices, or at the prices that others may be selling at in this place.

Yours respectfully,

WOODCOCK, SMITH & Co.

A letter addressed to this firm, March 17, 1813, quotes the price of card wire at \$1.50 per pound for Nos. 30, 31, and 32; but as it was subject to daily fluctuation, the quotation was guaranteed only for the time of its making. The war with England had made wire a very scarce commodity. We have mentioned the granting of letters-patent to Pliny Earle, in 1803, for a machine for pricking twilled cards. This patent Mr. Earle was particular in defending for his exclusive benefit, and infringers were warned of their infraction as soon as it came to his knowledge. It appears from the following document that Messrs. Woodcock, Smith & Co. were using the patent in violation of Mr. Earle's rights, which drew from him a most emphatic protest and a demand for indemnity:—

LEICESTER, 11th Mo., 18, 1813.

To John Woodcock, Alpheus Smith and James Smith, each of you and all of you: I hereby in the most peremptory terms forbid your using my inventions and improvements in making regular and complete twilled or nailed cards, which improvements are secured to me by law in the Patent-Office of the United States, as you will be holden to answer all such violations and encroachments at your peril, agreeably to the

laws in such cases made and provided. And I do hereby require you forthwith to settle with me, and make me just and honest reparation for all former violations and encroachments on my said improvements and inventions. Now, in order that you may not deceive yourselves or be deceived, I have left Fessenden's Law of Patents with Bradford Sumner, at Nath'l P. Denny's former office, where you may call and be informed if you wish. I have been at the expense of paying an attorney for advice, and a journey from Boston, and am now acting agreeably to his directions.

PLINY EARLE.

Upon Alpheus Smith's withdrawal from his partnership with James Smith, in 1814, he established a card-factory in his own name, and carried on a large business till 1823, when he disposed of it to his brother Horace, who remained in it till the time of his death in 1828.

When Mr. John A. Smith dissolved his connection with Mr. James Smith and others, in 1830, he started a similar business on his own account, which he continued till 1844, when he was succeeded by Samuel Southgate, Jr., and his son, John S. Smith, who conducted the business under the firm-name of Southgate & Smith till January 1, 1859, when the senior member retired and his interest was taken by Horace

Waite. The firm of Smith & Waite lasted till 1867, when Mr. Smith's interest was bought by sons of Mr. Waite, — E. C. and L. M. Waite, — and the firm-name changed to E. C. & L. M. Waite & Co., the father giving the sons the benefit of the name. This remained till March 10, 1874, when the present firm was formed under the style of E. C. Waite & Co.

A good-sized business was done by Jonathan Earle in his own house from 1804 to 1813. He was an active and successful manufacturer. His residence and factory was situated on Mount Pleasant, lying about a mile west of the village meeting-house.

In 1810 the firm of Southgate & Sargent commenced business. The members, Capt. Isaac Southgate and Col. Henry Sargent, then young men, became identified with the progress of the town as successful manufacturers, and their names have been long known in the annals of Leicester. Col. Sargent remained in the firm but two years when he formed a new concern, and in 1814 took in his brother, Joseph D. Sargent, as a partner. The latter left in 1819 and started business for himself in the manufacture of

“hand and machine cards,” having at different times as partners, Silas Jones, Nathan Ainsworth and William Boggs. March 1, 1836, he sold his machine-card business and machinery to Joshua Q. Lamb and Alonzo White, while he continued the hand-card business till his death in 1849. Col. Henry Sargent remained alone after the withdrawal of his brother till 1829, the year of his death. Captain Southgate conducted his manufacturing without a partner from 1812 to 1826, when he associated with him Joshua Lamb, Dwight Bisco, Joseph A. Denny and John Stone, under the name of Isaac Southgate & Co. Mr. Stone died the next year. In 1828 they erected a factory in the rear of the meeting-house. In 1831 Mr. Lamb left the firm, and Capt. Southgate did the same in 1843, which left the business in the hands of Messrs. Bisco & Denny, who, in 1857, took in their sons, Charles A. Denny and George Bisco. Joseph A. Denny died in 1875, and Dwight Bisco died in 1882. John W. Bisco was admitted to the firm in 1882. Mr. Dwight Bisco was in continuous business for fifty-six years,—a length of time that is allowed to but few men. He was born in Spencer in 1799, and went to Leicester, when twenty-three years old, “with

a strong constitution, a few articles of clothing tied in a bundle, and a silver dollar in his pocket, which was his capital for beginning his business career. He at once engaged himself to serve an apprenticeship and learn the trade of the card-clothing business with Cheney Hatch, and continued in his employ until 1826."

Mr. Cheney Hatch started a factory in 1823 and ran it till 1836, when he sold out to Alden Bisco, who parted with it in a few months to Henry A. Denny, an elder brother of Joseph A. Denny. Mr. Denny continued the business till 1849, when he took in his sons, Joseph W. and William S., when the firm became known as Henry A. Denny & Sons, and so continued to 1854, when the factory, machinery and business was sold to White & Denny. Their factory was the only card-clothing factory in town at that time using steam-power. The manufacturing facilities of White & Denny were thus much enlarged. This firm was composed of Alonzo White and Christopher C. Denny, the latter a younger brother of Henry A. and Joseph A. Denny, who had formed a partnership for the manufacture of card clothing July 1, 1846. Mr. White, as has been seen, had an

earlier beginning, at the time he bought with J. Q. Lamb, in 1836, the business, etc., from J. D. Sargent. At that time the formation of the firm was made under the style of Lamb & White, with Liberty Lamb and Joshua Lamb as silent partners. The two latter gentlemen dissolved their connection at the termination of three years, otherwise the firm remained the same till July 1, 1846, when Mr. Lamb retired to engage in business by himself, which he did till his death in 1850. Mr. White continued the business with C. C. Denny as a partner. Mr. Denny sold his half interest in 1868 to H. Arthur White, when the firm-name was changed to A. White & Son, under which style it now exists.

Mr. Josephus Woodcock, a son of John Woodcock, who succeeded Winthrop Earle, began the manufacture of cards, in 1828, in connection with Benjamin Conklin, Jr., a brother-in-law, and Austin Conklin, under the name of Conklin, Woodcock & Co. Two years after, the dissolution of the firm placed the business into the hands of Josephus and his brother Lucius, who established the firm of J. & L. Woodcock & Co., which continued under that name for fifty-one years. Danforth Rice was in the firm from 1831 to

1836, and William P. White from 1848 to the time of his death in 1881. Upon the death of Mr. White the constitution of the partnership was materially changed, C. H. Woodcock taking the interest of his father, Josephus, and Henry Bisco the interest of Mr. White. The firm thereupon became known as L. Woodcock & Co., which is the existing style.

Samuel Southgate, Jr., and Joshua Murdock, under the firm-name of Southgate & Murdock, started a new business in 1840, but after three years Mr. Southgate withdrew to become associated with John S. Smith, as previously noticed. Mr. Murdock remained alone till 1847 when he was joined by his brother Joseph, and the firm of J. & J. Murdock established, which style has been preserved to the present time. In 1857 John N. Murdock, a younger brother, was admitted as a partner, in which condition it continued till March, 1882, when Joshua, the senior member, died. In that year was formed the existing constitution of the firm, viz.: Joseph, John A., and Julius O. Murdock, and Alexander De Witt — who sold out his interest in 1883.

Baylies Upham and Samuel Hurd became partners in 1825, and so continued till 1833, when Mr.

Upham took the business to himself and conducted it to 1850, when Erving Sprague became associated with him. The latter left the firm in 1855, and the next year Mr. Upham disposed of his business to J. & J. Murdock.

In the year 1842 John H. and William Whittemore formed a partnership. A younger brother, James, was admitted in 1845. In 1851 John H. Whittemore was killed on the cars on the Western Railroad, now the Boston & Albany. The style of the firm was changed at this time to W. & J. Whittemore, which is the same to-day. In 1874 W. F. Whittemore, son of James, became a partner. In 1882 James died.

It would be a difficult, if not impossible, task to give a record of all those who have engaged in the card-clothing industry in the town of Leicester. In addition to those already mentioned we notice the name of Reuben Meriam, as having been ten years in business, from 1821, with George W. Morse and Henry A. Denny as partners at different times. Harry Ward carried on a business from 1810 to 1824. Others can be named, as: Daniel Denny, Captain William Sprague & Sons, Barnard Upham, Roswell Sprague,

Samuel D. Watson, Aaron Morse, Guy S. Newton, Timothy Earle, Samuel Southgate, William H. Scott and Henry Earle.

We have referred to Joseph D. Sargent as an active manufacturer of card clothing in Leicester. He had two sons, Joseph B. and Edward, who became extensively engaged in the hand-card business, which proved very lucrative during the war; and in 1866 they organized the Sargent Card Clothing Co., and built a factory in Worcester, with Edward Sargent as manager. April 15, 1879, the factory and business was sold to James Smith & Co., of Philadelphia. Also in Worcester is the large establishment of the T. K. Earle Manufacturing Company that was established by Pliny Earle in 1786, and before referred to. January 1, 1867, C. A. Howard and Clarence Farnsworth commenced business under the firm-name of Howard & Farnsworth. In May, 1868, A. H. Howard was taken into the concern, and in the following October Mr. Farnsworth retired, leaving the two brothers together under the firm-name of Howard Bros., who conducted the business till 1870, when they took in their brother, J. P. Howard. Chas.

F. Kent commenced the making of Card Clothing in January, 1880.

The present Stedman & Fuller Manufacturing Co., formerly of Lawrence, Mass., but now of Providence, R.I., is a recently incorporated company. Its history, as a continuous concern, may be said to have commenced as far back as the year 1847, or about that time, when Smith, Walker & Co. came to Lawrence from Enfield, Mass., to engage in the manufacture of card-clothing, with an established connection with Jones, Wood, & Co., of Enfield, — one of the oldest card-clothing manufacturing firms in the country. They were succeeded in 1850 by Warren and Bryant; and this firm changed its partnership in 1856, by the sale of Mr. Oliver Bryant's interest to S. M. Stedman and George A. Fuller, — two employés, — which occasioned a change in the firm-name to Stedman & Fuller. In 1858 this new firm purchased the machinery, fixtures and stock of the Enfield concern, then owned by Rufus D. Woods, and moved the same to their Lawrence factory. No change was again effected till August 1, 1883, when the business was incorporated under its present style and name.

Davis & Furber Machine Co., of North Andover,

Mass., added the manufacture of card clothing to their business about twenty years ago, and are now engaged in it, though it holds a subordinate position to their other work. In addition to the concerns before mentioned are the following: D. F. Robinson, located at Lawrence, Mass.; the Lowell Card Co., at Lowell, Mass., and E. P. Stetson, who carries on business at Walpole, Mass.

We have seen that Amos Whittamore visited England in 1799 to secure to himself the advantage of his invention in that country; but his efforts proved of no avail, and the first patent granted in that country for a card-setting machine was that given to J. C. Dyer, of Manchester. Nothing, however, appears to have been done with this invention till a long time after, — about 1830, — when Mr. Dyer visited the United States and obtained a machine, and commenced business in Manchester, on a very extensive scale, under the firm-name of J. C. Dyer & Co. This firm was the first to successfully set cards mechanically. The machine used was probably for making the clothing in sheets, and the adaptations for the making of fillet were subsequently applied, as we observe that Mr. James Walton, of Houghton Dale

Mills, Denton, near Manchester, not only greatly improved Mr. Dyer's machine, but constructed the fillet machine that has remained practically the same to this day, or for a period of over forty years. One of these machines was on exhibition as early as 1838, at a fair at Lowerby Bridge.

CHAPTER VI.

LATER INVENTIONS AND IMPROVEMENTS IN THE MANUFACTURE OF CARD CLOTHING. — VARIETIES MADE.

THE mechanical history of the industry is represented in the daily operations of any card-clothing factory; it is a thousand times repeated in the course of the year, and the many devices which make up its parts and exhibit its condition have been, in essential features, familiar to the workman for a generation or more. Everything connected with the manufacture of card clothing bears the imprint of intelligence in the careful and exact manipulation of the materials that go into the final product. The machines that insert the teeth impress the observer with being in the presence of an inanimate object possessing a conscientious sense of duty. The employés that are to be met with in every department carry with them the character of thoughtful intelligence upon which society can safely depend for its moral support.

The first step in the manufacture of card clothing

is the selection of the material for the foundation or backing into which the teeth are to be inserted. The selection is influenced by the purpose for which the clothing is to be used, the stock that it is to card, and its relative cost. Leather is most universally used, and has been employed from the earliest beginning. For some purposes its advantages are superseded by other materials that have been constructed of cloth and rubber, though the prime consideration for substitution was occasioned by the matter of less cost. The kinds of *leather* that are used are the hemlock and oak tanned. The first is more generally employed, as it possesses more pliability and greater compactness, aside from making a smoother and better appearing piece of work.

Those unacquainted with the requirements for which leather is intended have but a slight appreciation of the discrimination that must be exercised in its selection, so that it may be alike in texture and other essential features. This difficulty is greatly increased when assortments have to be made from products of different tanneries.

Cloth backings vary in composition, and a majority of them have rubber in combination. The value

of *solid cotton cloth* is in its comparative cheapness, and it is exclusively applied to the cotton card. Its adaptation to other stock has been found insufficient and defective. All cloth *backings* have the matter of uniformity of thickness in their favor, which is a very valuable feature.

The *rubber-cloth backings* may be confined to those covered or having a facing on one side of either natural or vulcanized rubber. The body of this kind of clothing is made of several layers of cotton cloth, though in some cases linen is substituted. Its chief recommendations are its superior elasticity and the support which it gives to the teeth. It also possesses the elements of cheapness, strength and durability, which stand in more than favorable comparison. The employment of india-rubber in the manufacture of card clothing is not of recent invention, though it is only of late years that American mills have given it extensive use.

Natural rubber is successfully used only for the making of card clothing for carding cotton. Being quickly affected by changes in temperature, — hardening in a cold atmosphere, softening in a warm room, — and liable at any time to be ruined by oil carelessly

dropped on it by some workman, or from overhanging shafting, it cannot be relied on for uniform work, and is being rapidly displaced by cloth cards, and by the vulcanized rubber faced card clothing, which retains all the elasticity and other advantages of the natural rubber with none of its disadvantages.

Its advantages over leather are its cheapness and durability, and it is regarded by many as superior in its working qualities. The use of this kind of artificial material has another valuable feature in the firm and elastic support it gives to the wire teeth. It is well known that the holes in leather have to be made larger than the wire to allow for the insertion of the teeth, and, as the holes close up only partially, the teeth are left unsupported and with a considerable freedom of play. With an India-rubber and cloth foundation, the holes will contract about the teeth, permitting them to depend on the material for support and elasticity, thus securing an important aid towards durability. The strength of the clothing lies in the cloth, which is especially effective if constructed partly of linen, and "it would be very rough usage indeed in clothing cylinders with fillets which would cause its breakage."

Vulcanized rubber card clothing is used for all varieties of carding. It is made with several layers of cotton cloth, or cotton and linen cloths combined, covered by a thin layer of vulcanized rubber, spread on as paste, instead of natural rubber.

Vulcanized rubber faced cloth of the best quality is now taking the place of leather almost entirely for foundation or backing for card clothing for carding worsted wools, which are worked with a large amount of water and oil, where leather soon hardens, and the splices or laps in the filleting, no matter how well cemented and sewed, soon give way. There being no laps in rubber filleting there are no damages to clothing caused by the breaking of a piece of filleting which has come apart in a lap.

Over twenty years ago Horsfall, of England, invented a cloth for a backing for card clothing, which is still one of the best in use. It is made of a woolen cloth woven with a linen warp and covered on one or both sides with cotton cloth. The cotton cloth is cemented to the woolen by an oil cement which is unaffected by oil or temperature. The T. K. Earle Manufacturing Company has successfully made it for

thirteen years and recommend it for all carding where there is no moisture.

There are other constructions of clothing, but the foregoing are in most general use. Some forms have cotton cloth with rubber filling instead of rubber facing.

The wire that is now in greatest popularity is hardened and tempered steel, which will shortly be so universally used that the common iron wire will scarcely be known. Most of the wire that is put into clothing is of English importation, and some of the largest manufacturers have foreign correspondents, through whom they obtain a regular supply. Tempered steel wire is made to some extent in this country, and considerable improvements have been made within the last six or eight months; but up to this date general preference favors the English production. The cost of clothing with tempered steel wire teeth exceeds that with the common round iron wire about 75 per cent.; but to make amends for this great disparity in price, the steel wire more than offsets it in durability, in elasticity, in allowing a better and more lasting point, permitting harder usage and requiring less repairs.

The hardness of the wire is one of the important points which should receive the careful attention of the consumer. It is more difficult to make a nice-looking card of the hard than of the soft-tempered wire. The hard-tempered wire is far more durable, and requires less frequent grinding than the mild or soft-tempered wire.

The chief property of steel, and upon which it is particularly valued, is what is known as its temperability. By heating and cooling it in different degrees and at different rates of rapidity, almost any degree of hardness or softness may be obtained. The process of tempering steel wire for card-clothing purposes has not been successfully attempted in this country until recently. It may be generally understood by saying that the wire is drawn through molten lead, and hardened by being immersed in oil, and again passed through molten lead, at a lower temperature than the first, to give it the proper temper.

CHAPTER VII.

DESCRIPTION OF VARIOUS PROCESSES IN THE MANUFACTURE OF CARD CLOTHING.—PRESERVATION OF THE FIRST CARD-SETTING MACHINES.

THERE are several kinds of wire used in the manufacture of card clothing, which are made of either iron, steel or brass. The forms are either round or angular, the latter being cut with a diamond point. The round form is that most commonly met with, and is employed for all ordinary clothing, in both sheets and filleting. The angular form is generally given to such wire as is intended to perform heavy work, and is particularly adapted to covering feed-rolls, lickens-in, tumblers and cylinders of carding machines designed for carding shoddy and similar waste. The diamond point, which is given to the angular wire, is destroyed by any attempt at grinding, therefore when it has been worn off by use, the clothing is beyond redemption and should be replaced by new. It is in its best condition when it first comes from the maker's hands. Round wire is in an

imperfect condition as it comes from the maker's hands and has to be ground with emery before it can perform its duty. The brass wire has its sphere of usefulness in places where dampness exists, and only in such places is it employed, as on cloth-drying machines, etc. Tin-plated wire is also used in moist places, especially for worsted carding.

The processes through which leather is made to pass in order to fit it for conversion into card clothing, are simple in their parts, but require much care, exactness, and discriminating judgment. The proper selection of leather is an important item in the successful conduct of a factory, and no inferior talent can be prudently allowed in this first step towards manufacture. The leather that is suitable for card clothing is taken from the back and side of the hide. The best portion, that through the center of the side, is chosen for the sheets, the next in quality for filleting, and that along the back is used for coarse and heavy wire, such as the angular wire, etc. As none but clean stock can be employed, it will be readily appreciated that there must be a considerable amount of waste made, which increases relatively the cost of the stock that is selected. One-quarter to one-half

of the hide is thus rejected as waste, so to speak, and sold as remnants, at a low valuation, say from one-third to one-half of the cost.

The operations connected with the progress of manufacture of sheets and filleting are similar, varying in certain particulars according to the nature of their design. The hides, having been cut up into proper forms, are put into water to soak till they become soft and pliable. The various strips of leather are then put through a splitting machine to bring them to a uniform thickness. A second wetting process is then gone through with, followed by an operation of stretching by rubbing, laterally for sheets and lengthwise for filleting. The leather is now subjected to treatment with a mixture of neat's-foot oil and tallow, technically called stuffing, because the pores are thoroughly filled with the grease. In this condition it is hung up to dry, and when this is accomplished the sheets have their edges trimmed and straightened, and the fillets are trimmed to a certain uniform width. The sheets are now dry-stretched laterally on a machine, then limbered on what is termed a gridiron, and thus made ready to receive the teeth. The fillets, after trimming, are matched, that is, the ends of the

strips are bevelled off at a very acute angle, and then lapped and glued together into one long continuous piece. Before uniting the short strips, they are carefully sorted and classified according to flexibility and condition, and those of a kind are put together. The long pieces are put up into rolls from 300 to 400 feet in length. After gluing, the filleting is for a second time passed dry through a shaving machine, to equalize thickness, and it is then trimmed to width and finished ready for the teeth.

There are very few who engage in the manufacture of card-setting machines, and none who make it a special business to the exclusion of others. The machines that are made come from the shops of the large card-clothing manufacturers, who supply not only their own wants but those of the smaller establishments. This is explainable from the fact that a machine has a long life, and a factory once supplied has no occasion to make further purchase in the way of renewals, and the only bill of expense is that which arises from necessary repairs. Little account is taken of improved machinery any further than certain accessories which can be adjusted to most every kind of machine. Fundamentally there has been but

2

little improvement for a great many years, and machines that are from thirty to forty years old are in successful operation to-day, favorably competing with those of more modern construction. We do not mean, however, to be understood that there has been no progress made; but the advance has not been so material as to incapacitate machines made twenty-five years ago from doing good work in competition with those of recent make.

While we are at this point of our subject it may be fitting to dwell upon a little episodal history connected with the manufacture of card machines. We wish to state the obligation we owe to Mr. Thomas A. Dickinson, of Worcester, Mass., for the great assistance he has rendered in furnishing us with the larger portion of the material from which the following is composed. We desire to furthermore acknowledge the willing aid we have received from this gentleman in other portions of this series. There is a card-tooth machine now in the possession of a Worcester party, manufactured by Joshua Lamb, of Leicester, about sixty years ago. It is in excellent running order, and capable of making from 500 to 600 teeth per minute. It was made by Mr. Lamb as

an improvement on his upright arbor machine, which he patented in 1819, and which is now in the Museum of the Worcester Society of Antiquity, where also may be seen a circular card-tooth machine, that was made about 1810, but by whom we have been unable to find out. In the same place may be found a card-tooth machine made by Eleazer Smith about the year 1814, and which, it is thought, was made for Pliny Earle of Leicester. In addition to the above machines Joshua Lamb obtained letters-patent on a card-setting machine in 1827. Reuben Merriam of Leicester, secured letters-patent on a card-filleting, or cub, prick, and set machine in 1831.

It would seem unjust if no mention was made of some other prominent mechanics and inventors who have made valuable improvements in card-setting machines. There are no doubt many names that could be added to the list, but we have been able to come into possession only of the following: Joseph Elliott, who lived in Leicester in 1828, was one of the first to make decided improvements in the card machine. He afterward removed to Enfield, Mass., and made machines for Jones, Woods & Co., of whom we have spoken heretofore.

The Porter Brothers were ingenious mechanics of Springfield, Vt., who commenced the manufacture of cards about the year 1830, with machinery of their own invention. They were the first to put stop-motions on the machine, and the same stop is now in use in some of the factories in Worcester. Rufus Sargent started the card-setting business in Auburn, N.Y., and many of his machines were of his own design and manufacture. He was the first to apply the jointed die stop, hung on centres. A Mr. Coates of Springfield, Mass., made the first machine for making endless doffer-rings, in 1852 or 1853. He took out letters patent for it in 1854. William B. Earle, now living at the age of eighty-five, commenced building card machines in 1828. In 1837 he received a silver medal from the Massachusetts Charitable Mechanic Association for a card-sticking machine. Some of the machines in use by the T. K. Earle Manufacturing Company, Worcester, were made by him. Great credit is due to the names of Addison Arnold, Nathan Ainsworth, David McFarland, Austin Conklin, Augustus B. Prouty, David O. Woodman, Charles Ballard and Oliver Arnold, for the progress which has been made in the card-clothing industry.



APPENDIX.

1738. — John Wyatt's patent on Cotton-Spinning Machine.
1743. — John Kaye invented Fly Shuttle.
1748. — Lewis Paul patented Cylinder Card for carding cotton.
1754. — Eleazer Smith born in Medford, Mass.
1759. — Amos Whittemore born in Cambridge, Mass., April 19.
1762. — Dec. 17. Pliny Earle born in Leicester.
1770. — Sir Richard Arkwright's improvements on Paul's Card.
1775. — Above improvements patented.
Winthrop Earle born.
1778. — Oliver Evans' Machine for making Card Teeth introduced.
1780. — Eleazer Smith first thinks of complete Card-Setting Machine.
1784. — Chittenden's invention on Card Machine.

1785. — Edmund Snow of Leicester commenced making Hand Cards.
1786. — Pliny Earle commenced business, thus establishing Card-Clothing industry now carried on by the T. K. Earle M'fg Company, of Worcester, Mass.
1788. — Evans' invention applied to Card Machine by Giles Richards.
1789. — President George Washington's visit to the Card-Clothing factory of Giles Richards & Co. in Boston (Eleazer Smith, sup't).
Duty on Hand Cards 50 cents per dozen.
Samuel Slater left England for the United States.
1790. — Pliny Earle the first in the United States to make Machine-Card Clothing.
1791. — Firm of Pliny Earle & Brothers formed.
1792. — Eli Whitney invented Saw Cotton Gin.
1794. — Mark Richards manufactures Card Clothing near Faneuil Hall, Boston.
1797. — Patent granted Amos Whittemore for Card Machine.
1800. — William B. Earle born.
1802. — Winthrop Earle began the manufacture of Machine-Card Clothing in Leicester.

1803. — Samuel Whittemore manufactures Card Clothing in New York City.
Dec. 6. Patent granted to Pliny Earle on machine for Pricking Twilled Cards.
1804. — Jonathan Earle started in business this year and continued until 1813.
1807. — Winthrop Earle died.
1808. — Firm of Woodcock & Smith formed.
1809. — March 3. Renewal of patent granted to Amos and William Whittemore, Jr.
1810. — Southgate & Sargent commence business. Harry Ward in business from this year to 1824.
1812. — June 27. Prices of Card Clothing; see page 55.
July 20. Amos and William Whittemore, Jr.'s, patent leased to the New York Manufacturing Co.
Eleazer Smith built Card Machine for Pliny Earle and Brothers.
Duty on Hand-Cards \$1.00 per dozen.
1813. — March 17. Prices Card Wire; see page 56.
1814. — Henry and Joseph D. Sargent in partnership.

Alpheus Smith started Card Factory in own name and then sold to James and John A. Smith & Co.

1815. — Silas Earle commenced business.

1818. — The New York Manufacturing Co.'s machinery, etc., sold to Samuel and Timothy Whittemore, brother and son of Amos.

1819. — Joseph D. Sargent started business in own name.

1823. — Timothy Keese Earle born February 11.

1825. — John Woodcock, Jr., Hiram Knight and Emory Drury partners in firm of James and John A. Smith & Co.

Baylies Upham and Samuel Hurd manufacture Card Clothing from 1825 to 1833.

1826. — Firm of Isaac Southgate & Co. commence business with Joshua Lamb, Dwight Bisco, Joseph A. Denny, John Stone and Isaac Southgate.

1827. — Gershom and Henry Whittemore, sons of Amos, start Card Factory at West Cambridge, Mass.

John Stone, one of firm of Isaac Southgate & Co., died.

1828. — William B. Earle commenced building Card
Machines.
March 27. Amos Whittemore died.
Josephus Woodcock, Benjamin Conklin, Jr.
and Austin Conkling began manufact-
uring Cards.
Factory erected by Isaac Southgate & Co.
1832. — Pliny Earle died.
1833. — Baylies Upham bought out Samuel Hurd's
interest in firm of Upham & Hurd.
1836. — March 1. Joseph D. Sargent sold Machine
Card business to Joshua Q. Lamb and
Alonzo White.
Eleazer Smith died March 9, aged 82 years.
Cheney Hatch sold out to Alden Bisco, who
sold out in a few months to H. A. Denny.
1837. — William B. Earle received silver medal
from Massachusetts Charitable Mechanic
Association for Card-Sticking Machine.
1839. — Timothy K. Earle commenced Card business.
1842. — Timothy K. Earle moved Card-Clothing
business from Leicester to Worcester and
associated his brother Edward with him;
firm name T. K. Earle & Co.

1843. — Medal awarded to T. K. Earle & Co. by American Institute.
1844. — John A. Smith succeeded by Smith & Southgate.
1845. — James Whittemore admitted to firm of John H. & Wm. Whittemore.
1846. — Medal awarded T. K. Earle & Co. by American Institute.
1847. — Joshua Murdock joined by his brother Joseph; firm-name J. & J. Murdock.
1848. — Firm of Woodcock, Knight & Co. formed. William P. White with firm of J. & L. Woodcock & Co.
1849. — Henry A. Denny & Sons started.
1850. — Smith, Walker & Co. succeeded by Warren & Bryant.
Erving Sprague associated with Baylies Upham to 1855.
1851. — Medal awarded T. K. Earle & Co. at Crystal Palace, England, for excellence of goods.
Medal awarded to T. K. Earle & Co. by Worcester County Mechanics' Association.
1852. — This year or 1853 the first machine was built for making Endless Doffer Rings.

1853. — Medal awarded T. K. Earle & Co. by Massachusetts Charitable Mechanic Association.
1854. — H. A. Denny & Sons sold business to White & Denny.
Coates' Endless Doffer Ring machine patented.
1856. — Oliver Bryant sold out to Stedman & Fuller.
1857. — T. K. Earle & Co. built present factory in Worcester, Mass.
1862. — Card factory of Gershom & Henry Whittemore at West Cambridge, Mass., burned down.
1867. — Firm of Howard & Farnsworth started.
E. C. & L. M. Waite buy out John S. Smith.
1868. — A. H. Howard admitted to firm of Howard & Farnsworth in May.
C. Farnsworth retired in October.
White & Denny changed to A. White & Son.
1869. — Edward Earle retires from business.
1870. — J. P. Howard admitted to firm of Howard Brothers.
1871. — Thomas Earle died.

1872. — Edwin Brown admitted to firm of T. K. Earle & Co.
1873. — T. K. Earle & Co. commenced the manufacture of Woolen Card Cloths.
1875. — Joseph A. Denny died.
1877. — Edward Earle died May 19.
1879. — Sargent Card-Clothing Co. sold out.
1880. — T. K. Earle Manufacturing Company formed January 1st, with T. K. Earle, President, and Edwin Brown, Agent and Treasurer.
1881. — T. K. Earle died October 1st, aged 58 years. First Hardened and Tempered Cast Steel Wire for Card Clothing imported from James Royston, Son, & Co., Halifax, England, and used by *T. K. Earle Manufacturing Company*.
William P. White died.
L. Woodcock & Co. formed.
1882. — Tablet erected to memory of Amos Whittemore.
Joshua Murdock died in March.
James Whittemore died.
Dwight Bisco died.

1883. — Factory for making Card Cloths erected by the T. K. Earle Manufacturing Company. Alex. DeWitt sold out interest in firm of J. & J. Murdock.
1884. — Additions made to T. K. Earle Manufacturing Company's Cloth Factory.
1886. — Centennial Anniversary of establishment of T. K. Earle Manufacturing Company's Card-Clothing business.

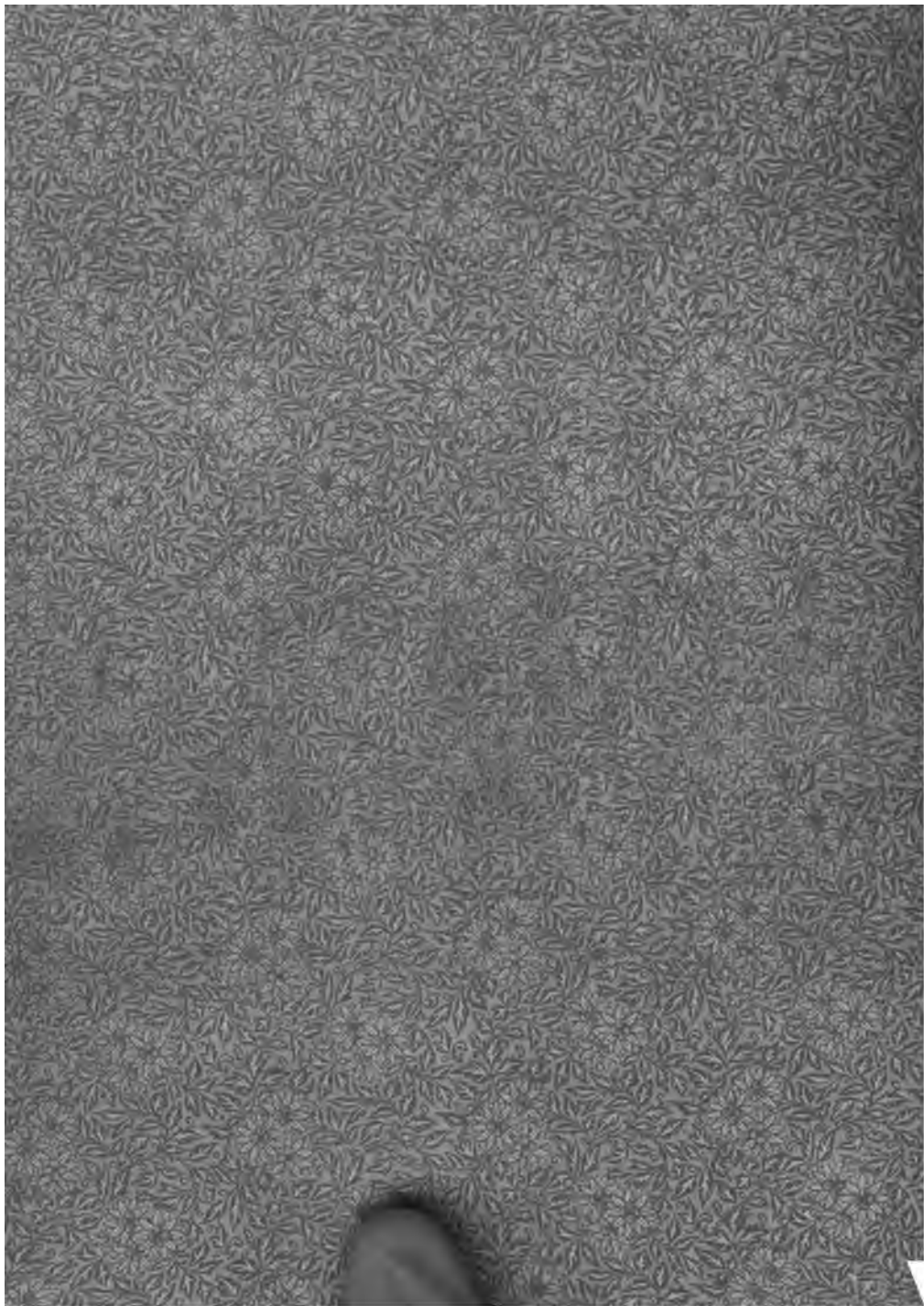


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the 1990s, the number of people with diabetes has increased in all industrialized countries. In the Netherlands, the prevalence of diabetes is 6.5% (1.5% of the population with type 1 diabetes and 5% with type 2 diabetes) [1]. The prevalence of type 2 diabetes is increasing rapidly, especially in the elderly population.

Diabetes is a chronic disease with a long asymptomatic period. The asymptomatic period is often followed by a period of slowly progressive hyperglycaemia. The hyperglycaemia is associated with an increased risk of complications. The complications of diabetes are the cause of disability and death. The complications of diabetes are: retinopathy, nephropathy, neuropathy, cardiovascular disease, and foot ulcers.

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